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III. "On the Lines of the Solar Spectrum." By Sir DAVID BREWSTER, K.H., D.C.L., F.R.S., and Dr. J. H. GLADSTONE, F.R.S. Received January 26, 1860.

(Abstract.)

In a paper in the Transactions of the Royal Society of Edinburgh for 1833, Sir David Brewster stated that he had examined the lines of the solar spectrum, and those produced by the intervention of nitrous acid gas, and had delineated them on a scale four times greater, and in some parts twelve times greater than that employed in the beautiful map of Fraunhofer. None of these drawings, however, were published at the time; they were increased by frequent observations continued through succeeding years; and now having been collated, arranged, and added to by Dr. Gladstone, they form the diagrams accompanying this paper.

The figures consist of—

1st. A map of the whole spectrum 58 inches long, and exhibiting about 1000 lines and bands. This map includes a great prolongation of the spectrum at the least refrangible end, before A, with a series of bands and lines not hitherto described.

2nd, 3rd, 4th, and 5th. Enlarged delineations of the portions of the spectrum between A and B, and between E and F, exhibiting additional lines, with still more magnified views of the groups *a* and *b*.

6th. A map of the two extremities of the solar spectrum as observed by Dr. Gladstone about noon-day at midsummer, consequently when the sun was at its greatest altitude. This shows several bands between A and B, and a series of lines in the lavender rays extending as far as M. Becquerel's N, and corresponding evidently with the maps published by him and by Professor Stokes, with the addition of finer lines. Yet this map represents the extreme spaces of the spectrum where there is no effect on the organ of vision, while that of M. Becquerel represents the want of chemical action, and that of Professor Stokes the absence of fluorescent power.

7th. A map of the "atmospheric lines" compiled from the independent observations of the two authors. These lines and bands are visible only when the sun is rising or setting, that is to say, when his beams traverse a long stratum of our atmosphere. In some cases

they are merely the deepening of bands seen at any time, in other cases they are bands which appear for the first time when the sun is close to the horizon. Professor Piazzi Smyth has represented some of these lines in his delineations of the spectrum as observed from the Peak of Teneriffe, whence he had the advantage of seeing the sun at an altitude of $-1°{\cdot}1$. The most remarkable of the atmospheric lines are situated in the orange and yellow spaces, and one band just beyond D is discernible in the diffused light of a dull day at any hour, though it covers what is about the brightest part of the prismatic image obtained from direct sunshine. The western sky after sunset exhibits these phenomena in a striking manner, and with some variations that do not appear to depend altogether on the absence or presence of moisture, although when the sun looms red through a fog these lines also make their appearance. They are in no respect due to the mere reduction in the quantity of light.

The dispersion and absorption of the more refrangible rays by the atmosphere, and by fogs, smoke, and such media as dilute milk and water, is a quite independent phenomenon.

8th and 9th. Enlarged views of A and B, when the light is acted upon by a long passage through the atmosphere.

10th. A map of the spectrum, exhibiting on a large scale the dark lines and bands which were seen by Sir David Brewster when nitrous acid gas is interposed between the prism and the source of light. Their position is identified by the insertion of the principal lines of the solar spectrum. They differ considerably from a smaller drawing of the same by Professor W. A. Miller, who employed a deeper stratum of the red gas.

The light of the moon, which is only that of the sun reflected from her surface, exhibits all the principal lines from about B to H, and no fresh ones; and when the luminary was near the horizon, the more prominent atmospheric lines were detected. The green colour was observed to extend a little beyond F in the spectrum of moonlight, and the space between G and H appeared lavender or lavender-grey instead of violet.

In respect to the origin of these lines, it is conceivable that the light when emitted from the photosphere itself is deficient in these rays, or that they are due to absorption by the atmosphere of the sun, or by that of the earth. The first of these suppositions scarcely admits

of a positive proof. If the second be true, it might be expected that the light from the edge of the solar disk would exhibit more of these absorption bands than that from the centre, which must have traversed a smaller amount of atmosphere; but such was not found to be the case. The third supposition is favoured by the fact that the atmosphere has unquestionably much to do with the manifestation of many of these lines, and by the analogy of the bands produced by nitrous acid gas, bromine vapour, and other absorbent media. The *experimentum crucis* of observing an artificial light through a long space of air was attempted by means of the revolving light on Beachy Head, as seen from Worthing at a distance of twenty-seven miles. It gave a negative result; but on account of the great difficulty of detecting slight breaks in a faint thread of light, no great reliance is to be placed on the experiment. A similar doubt rests on the authors' observations of fixed stars, and on the non-recognition by Fraunhofer of the ordinary lines in the light of Sirius and Castor, while on the other hand he did detect D and *b* in that of other stars. The origin of these lines is still an open question.

The spectra of artificial flames sometimes exhibit bright lines coincident with the dark spaces of the solar spectrum. Thus the yellow band in the flames of soda, and several other substances, is identical in refrangibility with D; but the most remarkable case is that of charcoal or sulphur burnt in nitre; the spectrum shows three very prominent lines, two of which coincide with A and D, while a faint red line appears at B, and a group between it and A.

A map is also given of the bright lines, principally orange, that make their appearance when nitrate of strontia is placed on the ignited wick of a spirit-lamp.

IV. "On some New Volatile Alkaloids given off during Putrefaction." By F. Crace Calvert, Ph.D., F.R.S., &c. Received February 23, 1860.

Some eighteen months ago my friend Mr. J. A Ransome, surgeon to the Royal Infirmary, Manchester, induced me to make some researches with the view of ascertaining the nature of the products given off from putrid wounds, and more especially in the hope of